

WHAT IS CLAIMED IS:

1                   1.       A mixing apparatus for mixing a flowable material, the mixing  
2 apparatus comprising:

3                   a first body having a first mating surface and a plurality of first cavities  
4 formed on the first mating surface, the plurality of first cavities being arranged along a first  
5 path to provide a variation in depth measured from the first mating surface; and

6                   a second body having a second mating surface configured to mate with the  
7 first mating surface of the first body, the second body including a plurality of second cavities  
8 formed on the second mating surface, the plurality of second cavities being arranged along a  
9 second path to provide a variation in depth measured from the second mating surface;

10                  wherein the first mating surface of the first body is mated with the second  
11 mating surface of the second body to align the first path with the second path, the first  
12 cavities fluidically communicating with the second cavities to form an internal flow path from  
13 an inlet through the first cavities and second cavities to an outlet, the internal flow path  
14 having multiple depth turns to direct flow between the first body and the second body formed  
15 by the depth variations in the first cavities of the first body and the second cavities in the  
16 second body.

1                   2.       The mixing apparatus of claim 1 wherein the first cavities are spaced  
2 from each other along the first path by first regions of zero depth measured from the first  
3 mating surface.

1                   3.       The mixing apparatus of claim 2 wherein the second cavities are  
2 spaced from each other along the second path by second regions of zero depth measured from  
3 the second mating surface.

1                   4.       The mixing apparatus of claim 3 wherein the first regions of zero depth  
2 of the first path and the second regions of zero depth of the second path are staggered along  
3 the internal flow path.

1                   5.       The mixing apparatus of claim 1 wherein the multiple depth turns are  
2 spaced by substantially regular intervals.

1                   6.       The mixing apparatus of claim 1 wherein the first mating surface and  
2 the second mating surface are generally planar.

1                   7.       The mixing apparatus of claim 1 wherein the plurality of first cavities  
2       comprise at least one first cavity having a surface turn on the first mating surface.

1                   8.       The mixing apparatus of claim 7 wherein the surface turn is about 90°.

1                   9.       The mixing apparatus of claim 1 wherein the first mating surface is  
2       bonded to the second mating surface.

1                   10.      The mixing apparatus of claim 1 wherein the surfaces of the internal  
2       flow path are substantially free of cracks and crevices visible to human eye.

1                   11.      A mixing apparatus for mixing a flowable material, the mixing  
2       apparatus comprising:

3                   a first shell having a first mating surface and a plurality of first cavities formed  
4       on the first mating surface, the plurality of first cavities being arranged along a first path to  
5       provide a variation in depth measured from the first mating surface; and

6                   a second shell having a second mating surface configured to mate with the  
7       first mating surface of the first shell, the second shell including a plurality of second cavities  
8       formed on the second mating surface, the plurality of second cavities being arranged along a  
9       second path to provide a variation in depth measured from the second mating surface;

10                  wherein the first mating surface of the first shell is mated with the second  
11       mating surface of the second shell to align the first path with the second path, the first cavities  
12       fluidically communicating with the second cavities to form an internal flow path from an inlet  
13       through the first cavities and second cavities to an outlet, the first cavities being spaced from  
14       each other along the first path by regions of shallow depth from the first mating surface, the  
15       second cavities being spaced from each other along the second path by regions of shallow  
16       depth from the second mating surface, the first regions of shallow depth of the first mating  
17       surface and the second regions of shallow depth being staggered along the internal flow path.

1                   12.      The mixing apparatus of claim 11 wherein the plurality of first cavities  
2       comprise at least one first cavity having a surface turn on the first mating surface.

1                   13.      The mixing apparatus of claim 11 wherein the first mating surface and  
2       the second mating surface are generally planar.

1                   14.     The mixing apparatus of claim 11 wherein the first regions of shallow  
2 depth and the second regions of shallow depth comprise regions of zero depth.

1                   15.     The mixing apparatus of claim 11 wherein the first regions of shallow  
2 depth of the first mating surface and the second regions of shallow depth being staggered  
3 along the internal flow path at substantially regular intervals.

1                   16.     A method of making a mixing apparatus for mixing a flowable  
2 material, the method comprising:

3                   providing a first body having a first mating surface and a plurality of first  
4 cavities formed on the first mating surface, the plurality of first cavities being arranged along  
5 a first path to provide a variation in depth measured from the first mating surface;

6                   providing a second body having a second mating surface configured to mate  
7 with the first mating surface of the first body, the second body including a plurality of second  
8 cavities formed on the second mating surface, the plurality of second cavities being arranged  
9 along a second path to provide a variation in depth measured from the second mating surface;

10 and

11                   mating the first mating surface of the first body with the second mating  
12 surface of the second body to align the first path with the second path, the first cavities  
13 fluidically communicating with the second cavities to form an internal flow path from an inlet  
14 through the first cavities and second cavities to an outlet, the internal flow path having  
15 multiple depth turns to direct flow between the first body and the second body formed by the  
16 depth variations in the first cavities of the first body and the second cavities in the second  
17 body.

1                   17.     The method of claim 16 wherein mating comprises bonding the first  
2 mating surface with the second mating surface.

1                   18.     The method of claim 16 wherein the multiple depth turns are spaced by  
2 substantially regular intervals.

1                   19.     The method of claim 16 wherein the first body and the second body are  
2 formed by molding.

1                    20.     The method of claim 16 wherein the plurality of first cavities comprise  
2     at least one first cavity having a surface turn on the first mating surface.